IN THE CLAIMS

Claims 1-22 are pending in this application. Please amend claims 1, 3, 4, 10 and 12, and add new claims 14-22 as follows:

1. (Currently Amended) A magnetization control method, comprising:

providing at least one metal probe;

providing on a substrate a multilayer film including a first ferromagnetic metallic layer, a non-magnetic metallic middle layer formed on the first ferromagnetic metallic layer, and a second ferromagnetic metallic layer formed on the non-magnetic metallic middle layer and located facing said at least one metal probe;

controlling the distance between said at least one metal probe and said multilayer film at a range from approximately 0 nm to approximately 10 nm ~~so as not to contact said multilayer film;~~ and

providing an electric field between said at least one metal probe and said multilayer film to ~~become~~ set the height of the potential barrier ~~being~~ effectively high or low compared with a reference value so as to change the energies of quantum well states formed in the multilayer film, which results in recording ~~record~~ information to the multilayer film by changing at least one direction of magnetization of said ferromagnetic metallic layers.

2. (Previously Presented) The magnetization control method according to Claim 1, further comprising providing an anti-ferromagnetic layer between the first ferromagnetic metallic layer and the substrate.

3. (Currently Amended) An information recording apparatus, comprising:

at least one metal probe,

a multilayer film including a first ferromagnetic metallic layer, a middle non-magnetic metallic layer formed on the first ferromagnetic metallic layer, and a second ferromagnetic metallic layer formed on the middle non-magnetic metallic layer and facing said at least one metal probe,

wherein the at least one metal probe is structured so that a distance between said at least one metal probe and said multilayer film is controlled at a range from approximately 0 nm to approximately 10 nm ~~so as not to contact said multilayer film~~,

and at the same time an electric field between said at least one metal probe and said multilayer film is provided to set ~~become~~ the height of the potential barrier ~~being~~ effectively high or low compared with a reference value for recording information to the multilayer film corresponding to said electric field by changing at least one direction of magnetization of said ferromagnetic metallic layers so as to ~~record~~ change the energies of quantum well states formed in the multilayer film, which results in recording information to the multilayer film by changing at least one direction of magnetization of said ferromagnetic metallic layers.

4. (Currently Amended) An information recording apparatus, comprising:

at least one metal probe;

a multilayer film comprising a first ferromagnetic metallic layer, a middle non-magnetic metallic layer formed on the first ferromagnetic metallic layer, and a second ferromagnetic metallic layer formed on the middle non-magnetic metallic layer and facing said at least one metal probe,

wherein said at least one metal probe is structured so that a distance between said at least one metal probe and said multilayer film is controlled at a range from approximately 0 nm to approximately 10 nm ~~so as not to contact said multilayer film~~;

a controller wherein an electric field between said at least one metal probe and said multilayer film is provided to set ~~become~~ the height of the potential barrier ~~being~~ effectively high or low compared with a reference value for recording information to the multilayer film corresponding to said electric field by changing at least one direction of magnetization of said ferromagnetic metallic layers so as to ~~record~~ change the energies of quantum well states formed in the multilayer film, which results in recording information to the multilayer film by changing at least one direction of magnetization of said ferromagnetic metallic layers, and

wherein said at least one metal probe is structured so that, between said at least one metal probe and said multilayer film, there is applied a voltage for flowing tunnel current through to read information recorded by a change in said tunnel current corresponding to a change in a direction of magnetization due to an electric field which corresponds to the read information.

5. (Previously Presented) The information recording apparatus according to Claim 4, wherein

said multilayer film is formed as a disk-shaped recording medium for rotation;

said at least one metal probe is provided to oppose said multilayer film at a tip end of an arm, one end of which is rotatably supported and the other end side of which is extended to said disk-shaped recording medium;

and at the tip end of said arm, there is further provided a slider; whereby a distance between said at least one metal probe and said multilayer film is controlled by said slider so the at least one metal probe will not contact said multilayer film; and

wherein said at least one metal probe is structured so that an electric field between said at least one metal probe and said multilayer film is controlled to change at least one direction of magnetization of said ferromagnetic metallic layers for recording information corresponding to said electric field.

6. (Original) The information recording apparatus according to Claim 5, wherein in place of said tunnel current, information recorded by a provided GMR element or a TMR element located at the tip end of said arm is read.

7. (Previously Presented) The information recording apparatus according to Claim 4, further comprising:

a plurality of metal probes arranged at predetermined intervals in place of said at least one metal probe,

wherein said multilayer film faces said plurality of metal probes, and a distance between said plurality of metal probes and said multilayer film is controlled,

wherein an electric field between said plurality of metal probes and said multilayer film is provided to <u>set</u> ~~become~~ the height of the potential barrier ~~being~~ effectively high or low compared with a reference value for recording information to the multilayer film corresponding to the electric field by changing at least one direction of magnetization of said ferromagnetic metallic layers, and

wherein said plurality of metal probes are structured so that between said plurality of metal probes and said multilayer film, there is applied a voltage for flowing tunnel current through to read information recorded by a change in said tunnel current corresponding to a change in a direction of magnetization due to an

electric field which corresponds to the information read by said plurality of metal probes.

8. (Previously Presented) The information recording apparatus according to claim 3, wherein the second ferromagnetic metallic layer of said multilayer film which faces said at least one metal probe is made into domains which have been spatially divided in units of information to be recorded.

9. (Previously Presented) The information recording apparatus according to Claim 3, further comprising providing an anti-ferromagnetic layer between the first ferromagnetic metallic layer and the substrate.

10. (Currently Amended) A magnetization control method, comprising:

providing at least one metal probe;

providing on a substrate a multilayer film including a first ferromagnetic metallic layer, a non-magnetic metallic middle layer formed on the first ferromagnetic metallic layer, and a second ferromagnetic metallic layer formed on the non-magnetic metallic middle layer and located facing said at least one metal probe; and

controlling the distance between said at least metal probe and said multilayer film at a range from approximately 0 nm to approximately 10 nm ~~so as not to contact said multilayer film~~ and providing only an electric field between at least one metal probe and multilayer film to set ~~become~~ the height of the potential barrier ~~being~~ effectively high or low compared with a reference value so as to ~~record~~ change the energies of quantum well states formed in the multilayer film, which results in recording information to the multilayer film by changing at least one direction of magnetization of said ferromagnetic metallic layers.

11. (Previously Presented) The magnetization control method according to Claim 10, further comprising providing an anti-ferromagnetic layer between the first ferromagnetic metallic layer and the substrate.

12. (Currently Amended) A magnetization control method, comprising:

providing at least one metal probe;

providing on a substrate a multilayer film including a first ferromagnetic metallic layer, a non-magnetic metallic middle layer formed on the first ferromagnetic metallic layer, and a second ferromagnetic metallic layer formed on the non-magnetic metallic middle layer and located facing said at least one metal probe; and

controlling the distance between said at least metal probe and said multilayer film at a range from approximately 0 nm to approximately 10 nm ~~so as not to contact said multilayer film~~ and providing an electric field between at least one metal probe and multilayer film to ~~become~~ set the height of the potential barrier ~~being~~ effectively high or low compared with a reference value so as to change a quantum well stage which occurs in the multilayer film to change relative magnetization between the first and the second ferromagnetic metallic layer to ~~record~~ change the energies of quantum well states formed in the multilayer film, which results in recording information to the multilayer film by changing at least one direction of magnetization of said ferromagnetic metallic layers.

13. (Previously Presented) The magnetization control method according to Claim 12, further comprising: providing an anti-ferromagnetic layer between the first ferromagnetic metallic layer and the substrate.

14. (New) The information recording apparatus according to claim 7, wherein the second ferromagnetic metallic layer of said multilayer film which faces said at least one metal probe is made into domains which have been spatially divided in units of information to be recorded.

15. (New) The information recording apparatus according to claim 14, further comprising providing an anti-ferromagnetic layer between the first ferromagnetic metallic layer and the substrate.

16. (New) An information recording apparatus, comprising:

a recording medium having a multilayer film and a metal probe,

wherein the multilayer film has a first ferromagnetic layer, a non-magnetic layer formed on the first ferromagnetic layer and a second ferromagnetic layer formed on the non-magnetic layer,

a magnetic exchange interaction is working between the firs ferromagnetic layer and the second ferromagnetic layer,

a distance between the metal probe and the recording medium is controlled at a range from approximately 0 nm to approximately 10 nm,

a confinement potential on a surface of the recording medium changes by applying an electric field between the recording medium and the metal probe,

an energy of quantum well states in the multilayer changes by changing the confinement potential, which results in the recording information to the recording meduim by changing the magnetic directions of the fist magnetic layer and the second magnetic layer to become in parallel or anti-parallel.

17. (New) An information recording apparatus according to claim 16,

wherein said at least one metal probe is structured so that, between said at least one metal probe and said multilayer film, there is applied a voltage for following tunnel current through to read information recorded by a change in said tunnel current corresponding to a change in a direction magnetization due to an electric field which corresponds to the read information.

18. (New) The information recording apparatus according to claim 17, wherein

said multilayer film is formed as a disk-shaped recording medium for rotation;

said at least one metal probe is provided to oppose said multilayer film at a tip end of an arm, one end of which is rotatably supported and the other end side of which is extended to said disk-shaped recording medium;

and at the tip end of said arm, there is further provided a slider; whereby a distance between said at least one metal probe and said multilayer film is controlled by said slider so the at least one metal probe will not contact said multilayer film; and

wherein said at least one metal probe is structured so that an electric field between said at least one metal probe and said multilayer film is controlled to change at least one direction of magnetization of said ferromagnetic metallic layers for recording information corresponding to said electric field.

19. (New) The information recording apparatus according to claim 18, wherein in place of said tunnel current, information recorded by a provided GMR element or a TMR element located at the tip end of said arm is read.

20. (New) The information recording apparatus according to claim 17, further comprising:

a plurality of metal probes arranged at predetermined intervals in place of said at least one metal probe,

wherein said multilayer film faces said plurality of metal probes, and a distance between said plurality of metal probes and said multilayer film is controlled,

wherein an electric field between said plurality of metal probes and said multilayer film is provided to set the height of the potential barrier effectively high or low compared with a reference value for recording information to the multilayer film corresponding to the electric field by changing at least one direction of magnetization of said ferromagnetic metallic layers, and

wherein said plurality of metal probes are structured so that between said plurality of metal probes and said multilayer film, there is applied a voltage for flowing tunnel current through to read information recorded by a change in said tunnel current corresponding to a change in a direction of magnetization due to an electric field which corresponds to the information read by said plurality of metal probes.

21. (New) The information recording apparatus according to claim 20, wherein the second ferromagnetic metallic layer of said multilayer film which faces said at least one metal probe is made into domains which have been spatially divided in units of information to be recorded.

22. (New) The information recording apparatus according to claim 21, further comprising providing an anti-ferromagnetic layer between the first ferromagnetic metallic layer and the substrate.